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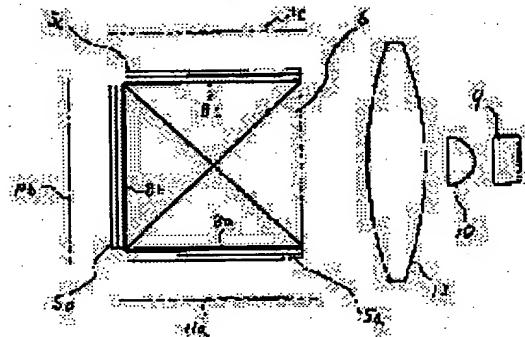
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(54) STRUCTURE OF LIQUID CRYSTAL PROJECTOR

(57)Abstract:

PURPOSE: To improve a problem that an optical unit and a product become large in size and heavy in weight, and improve an increase of the manhour for an assembly work and the manhour for adjustment, a deviation of a picture element position, and a limit of a liquid crystal panel cooling system by constituting the structure so as

to fix a liquid crystal panel to a synthetic optical means. **CONSTITUTION:** To a dichroic prism 6 for synthesizing a modulated light to a video light as a synthetic optical means, backpolarizing plates 8a-8c are stuck, and on the backpolarizing plates 8a-8c, liquid crystal panels 5a-5c are fixed with a UV binding material or a pressure sensitive adhesive having light guidability. In this regard, mutual picture elements of the liquid crystal panels 5a-5c are stuck by using a sticking jig, and by projecting a photographed image on a CRT, etc., by using a CCD 9, a picture element sticking adjustment work is executed. Naturally, an automatic adjustment for engagement can also be executed by an automatic machine. In this case, it is effective that they are aligned simple and precisely by time of a work for sticking mutually two pieces of glass panels 5a-5c.



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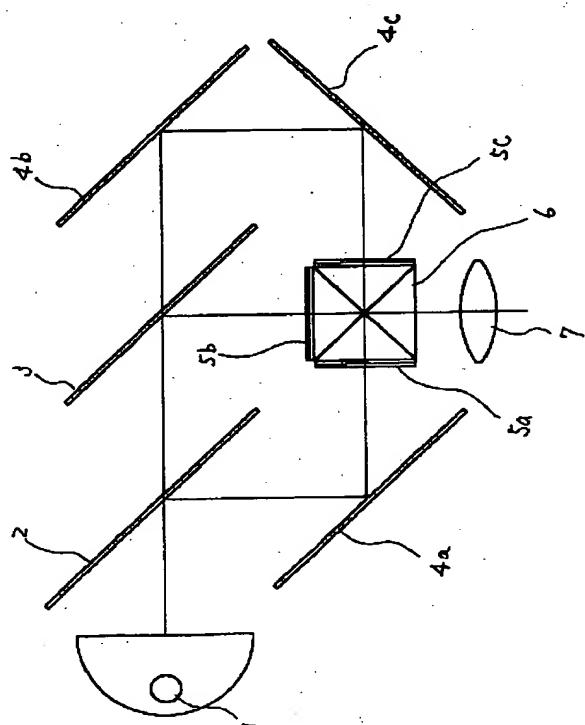
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(54)【発明の名称】 液晶プロジェクターの構造

(57)【要約】

【目的】 光学ユニットの液晶パネル間の画素位置及び投射レンズと液晶パネルとの焦点距離位置合わせを行なう調整機構を用いることによる光学ユニットの大型・重量化を改善し、部品点数増とこれに伴なう組立・調整工数増大と、外乱による画素ズレ、流体抵抗増大による液晶パネル冷却の限界等を改善した液晶プロジェクターを得る。

【構成】 ①ダイクロイックプリズムに液晶パネルを直接固定する構造とし、②液晶パネルにフレキシブルプリント基板を導通可能なように固着して回路手段と接続する構造とし、③ダイクロイックプリズムの出射面のみに後偏光板を配置する構造とする。



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【特許請求の範囲】

【請求項1】少なくとも、光源・該光源を赤・青・緑光に分離する分離光学手段・前記赤・青・緑光の各々を変調する液晶パネル・該液晶パネルを駆動・制御する回路手段・前記液晶パネルに変調された赤・青・緑光を合成する合成光学手段・該合成光学手段により合成された映像光を投影する投射レンズ等を有する液晶プロジェクターに於いて、前記合成光学手段に前記液晶パネルを固定するように構成したことを特徴とする液晶プロジェクターの構造。

【請求項2】前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記合成光学手段は少なくとも一つ以上のダイクロイックプリズムもしくはクロスミラー等を組み合わせて構成したことを特徴とする液晶プロジェクターの構造。

【請求項3】前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記合成光学手段は四辺形またはL字形の一体形状に構成されることを特徴とする液晶プロジェクターの構造。

【請求項4】前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記合成光学手段に前記液晶パネルを直接貼り付けた構造としたことを特徴とする液晶プロジェクターの構造。

【請求項5】前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記合成光学手段に前記液晶パネルを中間部材を介して貼り付ける構造としたことを特徴とする液晶プロジェクターの構造。

【請求項6】前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記液晶パネルは導通可能なように固着したフレキシブルプリント基板を有し、前記回路手段と導通を図る構造としたことを特徴とする液晶プロジェクターの構造。

【請求項7】前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記分離光学手段は赤・青・緑光の三原色光を二色以下に混合して分離し、前記合成光学手段に固定する前記液晶パネルは二つ以下としたことを特徴とする液晶プロジェクターの構造。

【請求項8】前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記液晶パネルを構成する後偏光板を前記合成光学手段の出射光面のみに配置したことを特徴とする液晶プロジェクターの構造。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、液晶パネルを用いた液晶プロジェクターの光学系の構造に関する。

【0002】

【従来の技術】従来は、(1)特願昭63-133872号の発明「液晶プロジェクタ」に開示されているように、回路基板に実装された液晶パネル54、55、56の各々は支持板65、66にねじ止めされて一体化され

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る。これを光学ヘッド17の上板59にバネ64によつて、前後・左右・上下方向(3軸方向)の位置決め調整を必要としている。また、(2)特願平3-28430号の発明「投射形液晶プロジェクタ」に開示されているように、回路基板10に実装された液晶パネル7a・7cの各々は固定板Aに固定される。固定板A～Dの4種類の固定板の相互の組み合わせ結合によって、左右・上下・回転方向(3軸方向)の画素間のアライメント位置決め調整を必要としている。更に、固定板Dと上下の2種の補助板29・34を介して上下の筐体8a・8bとの組み合わせ結合によって、前後・ピッチング(縦搖れ)・ヨーイング(片搖れ)方向(3軸方向)のフォーカス合わせ位置決め調整、即ち合計6軸方向の調整を可能とする調整機構を必要としている。

【0003】

【発明が解決しようとする課題】しかし、赤・青・緑光用の液晶パネルの相互の画素位置を精密に合わせようし、更に、スクリーンへの投射画面の焦点を鮮明に合わせようとする程調整機能は複雑化してしまう。加えて、より高画素化する場合も同様であり、以下の様な問題点を生じる。

【0004】(a)調整機構に於いて、先ず、液晶パネルはガラス材から構成されるため、補強・保護及び導通結合させるために回路基板等の介在部材を用いなくては調整機構に組み込めない。このため、調整機構の必要最小寸法が決まってしまい、本来の小型な液晶パネルのサイズに対して調整機構が大きくなってしまい、且、複雑な構造となる。次に、3軸もしくは6軸方向の調整を行なう調整ストローク分に加え、複雑化した機構部品の形状及び位置公差分を加味する量だけ更に大きくなると同時に、調整機構相互間の干渉防止を図るスペースをとることによって光学系の主要部分の平面サイズが決ってしまう。従って、光学ユニット及び製品が大型・重量化してしまう。

【0005】即ち、液晶パネル及びダイクロイックプリズムを小型化しても、小型化した量だけ光学ユニットが小さくできない構造的限界を有する。

【0006】次に、3軸もしくは6軸方向の調整を行なうためには各軸方向の調整を行なわせる部材を相互に積み重ねた構造とすることによって、投射レンズのバックフォーカスが大きくなり、使用レンズ枚数が増すために大型化する。

【0007】従って、製品の大型化・重量化による製品設計及びデザインへの制約条件を多くし、取扱い性・可搬性・設置性向上へのブレーキとなっている。

【0008】(b)調整構造の複雑化は部品点数を増加させる。部品点数の増加と部品の大型化(特に光学部品類)はコスト増加にダイレクト起因する。

【0009】(c)組立作業工数も部品点数に比例して増加する。液晶プロジェクタが多量生産する程市場が形

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成されていない現在、自動化は困難。従って人工数に頼る状況に於いては組立費増加は避けられない。

【0010】(d) 特に調整作業は人工数多く要する。加工費の中の数割以上を占めてしまう。

【0011】また、工程内に於ける部品交換（主に光学部品）が生じ易いために工数増が発生しやすい。更に、アフターサービスを行なう上で教育が難しく運用上大きなネックとなっている。

【0012】(e) 画素合わせ、フォーカス合わせ精度を均一に、しかも安定させることが大変である。人による作業環境はスクリーンに投影する画像を見て調整を行なえるようにするために暗い。この条件下では神経の集中が継続しにくく非常に疲れやすいことによる。

【0013】(f) 性能面に於いては、先ず、液晶パネルの相互の画素位置のズレ（以降画素ズレと言う）が衝撃及び振動を受けることによって生じ易い。調整機構自身の歪及び位置ズレに依るものと、筐体の歪が調整機構に伝わることに依るものとに起因する。これを防止するために光学ユニットの下筐体を剛性を有する材質でそれに合った製造方法（例えばアルミダイキャスト製造や、プレス部品の板厚増加とリブの溶接補強）を用いたり、外装筐体と光学ユニットへの歪の伝わり難い構造を採用したり、部品補強等によるコストアップと大型化が避けられない。

【0014】次に、画質に関して、光源のランプからの光束の一部が調整機構を構成する部材に当って反射した光が迷光となる。また、液晶パネルと偏光板との間に於いて反射した光も迷光となる。これ等の迷光が投射レンズに呑み込まれて投射映像のコントラストを落したり、ボケを生じ易くしている。更に、調整機構に加わる歪によって液晶パネルの液晶層のギャップにも少なからず影響を与える。これによって、透過率の変化を起こし、赤・青・緑光の合成バランスを崩して色ムラの起因となる。これ等を防ぐためには、必然的に調整機構及び光学ユニットが大型化し、また重くなってしまう。

【0015】次に、液晶パネルが遮光することによって高温となる。これを冷やす必要があるが液晶パネルは狭く、複雑な機構内に装着されているため、適正に冷やすためには冷却用空気の整流構造を必要とし、且、流体抵抗に打ち勝つ風圧と風速を必要とする。従って冷却用構造が複雑となり、また、パワーの大きな冷却ファンを用いるために騒音が大きくなる。また、ランプ光の光束が集中する液晶パネルの中央部分が高温となるが現状の冷却方式では十分冷却できず、従って、製品の使用温度範囲の高温側の規制要因となっている。

【0016】

【課題を解決するための手段】本発明の液晶プロジェクターの構造は、

(1) 少なくとも、光源・該光源を赤・青・緑光に分離する分離光学手段・前記赤・青・緑光の各々を変調す

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る液晶パネル・該液晶パネルを駆動・制御する回路手段・前記液晶パネルに変調された赤・青・緑光を合成する合成光学手段・該合成光学手段により合成された映像光を投影する投射レンズ等を有する液晶プロジェクタに於いて、前記合成光学手段に前記液晶パネルを固定するよう構成したことを特徴とする。

【0017】(2) 前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記合成光学手段は少なくとも一つ以上のダイクロイックプリズムもしくはクロスマラー等を組み合わせて構成したことを特徴とする。

【0018】(3) 前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記合成光学手段は四辺形またはL字形の一体形状に構成されることを特徴とする。

【0019】(4) 前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記合成光学手段に前記液晶パネルを直接貼り付けた構造としたことを特徴とする。

【0020】(5) 前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記合成光学手段に前記液晶パネルを中間部材を介して貼り付ける構造としたことを特徴とする。

【0021】(6) 前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記液晶パネルは導通可能のように固着したフレキシブルプリント基板を有し、前記回路手段と導通を図る構造としたことを特徴とする。

【0022】(7) 前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記分離光学手段は赤・青・緑光の三原色光を二色光以下に混合して分離し、前記合成光学手段に固定する前記液晶パネルは二つ以下としたことを特徴とする。

【0023】(8) 前記請求項1の前文で構成される液晶プロジェクターの構造に於いて、前記液晶パネルを構成する後偏光板を前記合成光学手段の出射光面のみに配置したことを特徴とする。

【0024】

【実施例】以下、本発明の液晶プロジェクターの構造の実施例を図面を用いて詳細に説明する。

【0025】図1は本発明の一実施例を示す光学ユニットの概略平面図、図2、図3は応用展開した一実施例を示す概略平面図であり、図4、図6、図7は図1の合成光学手段の部分のみを拡大した部分拡大図であり、図5は図4に対応する部分組み立て断面図である。1は光源であるメタルハライドランプ、2・3はランプ光を赤・青・緑光に分離するダイクロイックミラー、4a・4b・4cは分離されたそれぞれの光を伝達する反射ミラーで分離光学手段を構成し、5a・5b・5cは赤・青・緑光を変調する液晶パネル、6は合成光学手段として変

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調された光を合成して映像光にするダイクロイックプリズム、7は映像光を拡大投影する投射レンズである。合成光学手段6の詳細は先ず図4と図5に示す通り、前記ダイクロイックプリズム6に後偏光板8a・8b・8cを接着し、該8a・8b・8cの上に前記液晶パネル5a・5b・5cを接着する。尚、前記液晶パネル5a・5b・5cの相互の画素合わせは貼り合わせ治具を使用しCCD9を用いて撮映した映像をCRT(図中省略)等に映し出して画素合わせ調整作業をする。勿論、自動機によって完全自動調整をすることもできる。前記CCD9で撮映する照明光は前記CCD側から専用ランプ10によって照明するか、または、前記液晶パネル5a・5b・5cを透過させる方式も可能である。この画素合わせ作業に於いて、液晶パネル5a・5b・5cを構成する二枚のガラス板を貼り合わせる作業のときに用いる合わせマーク

(画素群外周部に設けた二重四角または四角形状等の認識用パターン)を用いて簡便、且、精確に合わせると効果的である。また、前記プリズム6と前記CCD9の間にレンズ12を配置して一度にCCD9が撮映できるよう撮影距離の調整も可能である。尚、合成光学手段6はダイクロイッククロスマラー方式のものであってもよい。

【0026】次に、11a・11b・11cの前偏光板は前記液晶パネル5a・5b・5cと分離して配置される。(勿論、冷却効率が高ければ一体化も可能)図5に示す通り、前記液晶パネル5bに形成された端子部には14の異方性導伝膜を介してポリイミドもしくはポリエスチル等を基材としたフレキシブル基板13を導通・圧着し、他端は回路手段(図中省略)にコネクター等によって接続している。前記フレキシブル基板13は細密で且、両面パターンを形成できるため、前記プリズム6の小型化の障害にならない。

【0027】次に、図6について図4との相違点について説明する。15a・15b・15c(各2個)は光軸方向に寸法精度を高めた金属または樹脂材から成る中間部材であり、前記後偏光板8a・8b・8cと前記液晶パネル5a・5b・5cの間に配置固定している。前記スペーサー15a・15b・15cによって形成された空間部15d・15e・15fは冷却用空気の流路を成すと共に、前記液晶パネル5a・5b・5cの着脱性を高めている。尚、前記中間部材15a・15b・15cは、UV接着または粘着剤等により接着されている。前記空間部15d・15e・15fのスキ間によっては、UV接着剤だけで中間部材を形成することも可能である。

【0028】次に、図7も図4との相違点について説明する。前記スペーサー15a・15b・15cを前記プリズム6と後偏光板8a・8b・8cとの間に配置したものである。

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【0029】さて、図2について図1との相違点について説明する。合成光学手段6はL字形の形状をしたダイクロイックプリズムの合体であり、図の様に液晶パネル5a・5b・5cを固定している。固定方法と構造は上記と同じである。また、図3は分離光学手段を構成するダイクロイックミラー2・3によってランプ光を緑・マゼンタ光に分離し、その中の1色光は反射板4に反射されて液晶パネル5aに、他の1色光は前記ダイクロイックミラー3に反射されて液晶パネル5bに至る。前記液晶パネル5a・5bに変調された光は合成光学手段としてのダイクロイックプリズム6に合成されて映像光となり、7の投射レンズによって拡大投射される。

【0030】次に図8は、前記ダイクロイックプリズム6の出射光面のみに後偏光板8を貼り付けることにより、前記液晶パネル5a・5b・5cは前偏光板11a・11b・11cだけを配置する構造を示すものである。後偏光板8の部品数と貼り付け工数削減に資する。

【0031】

【発明の効果】本発明は、以上詳述した如く、

(1) 合成光学手段に液晶パネルを固定するように構成し、前記合成光学手段は少なくとも一つ以上のダイクロイックプリズムもしくはクロスマラー等を組み合わせて構成し、また、前記合成光学手段は四辺形またはL字形の一体形状に構成されることによって、

a. 調整機構を不要とすることができる。これによって光学ユニット(製品)の小型化への機械的制約条件を無くすことができ、液晶パネルおよびダイクロイックプリズム自身の小型化が即反映できるようになる。これにより、ドライバー回路内蔵のポリシリコンTFTを使用した液晶パネルは小型であるメリットを最大限活かした製品の小型・計量化を実現できる。

【0032】b. 上記a項によって、製品設計とデザインの自由度を高め、より取扱性・可搬性・設置性の向上・改善を図ることが可能となる。

【0033】c. 部品削減と小型化により光学ユニットの構造は一段と簡略化できる。これにより、投げ込み方式の組立方式の採用と調整作業の削減によって大巾なコスト低減が図れる。更に、アフターサービス性も向上する。

【0034】d. ダイクロイックプリズムのサイズは液晶パネルのサイズに同等かやゝ大きい程度で良くなるため、投射レンズのバックフォーカスを短かくできる。従って、使用レンズ枚数の少ない小型な投射レンズの使用が可能となる。この効果として、光束の呑み込み量が増してスクリーン照度を増すことができ、また、小型・計量化とコスト低減に大きく寄与できる。

【0035】e. 画素合わせ及びフォーカス調整精度を均一化し、且、向上させることができる。フォーカス方向の精度は許容誤差以内の焦点位置のズレ量は投射レンズ位置およびダイクロイックプリズムの寸法精度では

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吸収可能であり、また、画素合わせは目視作業からC CDを利用した治具または機械合わせ作業を可能とするからである。

【0036】f. 振動・衝撃等による外乱によつても画素ズレは生じない。液晶パネルが剛性を有するダイクロイックプリズムに固定されるため、変形および位置ズレ等を防ぐことができるからである。これにより、光学ユニットの筐体の材質・製造方法等への制約条件が無くなり、樹脂材による筐体も可能となり、また外装筐体への強度・構造等歪に関する配慮を必要以上に払う設計負荷も軽減できる。

【0037】g. ランプ光が調整機構に乱反射して起こす迷光を抑えることができるため、投射映像のコントラストを損ねることを防止できる。

【0038】(2) 合成光学手段に液晶パネルを直接貼り付けた構造とすることによって、

a. 剛性を有するプリズムが液晶パネルを補強を兼ねるため、液晶層のギャップの変化を無くし、色ムラ防止を可能とする。

【0039】b. 更に、プリズムの熱容量が大きいため、液晶パネルの発熱を奪い冷却効果を有する。

【0040】(3) 合成光学手段に液晶パネルを中間部材を介して貼り付ける構造とすることによって、

a. プリズムと液晶パネルの間に中間部材によって生じる空間部が冷却用空気の流路を形成して液晶パネルを表裏面から冷やすことができる。これと共に調整機構削除を含めて流体抵抗を下げるため、低パワーの冷却ファンを使用でき、低騒音化が図れる。

【0041】b. 尚、本発明全体を通して、液晶パネル周辺部分の調整機が削除されるため、光束の集中する液晶パネルの中央部分を主体に冷却するように冷却ファンからの流路から導かれた空気をノズルによって吹きつけるようなスポットクーリング構造を設けるスペースが確保される。このスポットクーリングによって液晶パネル発熱のピーク値を抑えることによって製品の許容使用温度範囲を広げることができる。

【0042】c. 液晶パネルの冷却効率が高まることにより、ランプ光束を増すことができるため、開口率の小さな小型液晶パネル、または、多画素の液晶パネルにもランプ光束を落とすことなく対応できる。

【0043】d. 液晶パネル5a・5b・5cのいづれかが工程中または市場に於いて不良になった場合でも、前記中間部材15a・15b・15cの当該部品を外すだけで良品に脱着するだけで再生可能となり、廃却部品の削減と簡単な交換作業で行なえる。特に、アフターサービス性を改善し、消費者の費用負担額を減らすことができる。

【0044】(4) 液晶パネルは導通可能なように固定したフレキシブルプリント基板を有し、回路手段と導通を図る構造とすることによって、

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a. フレキシブルプリント基板は細密・両面パターンが可能であり、設計の自由度が高いので小型な基板設計ができるることにより、液晶パネルおよびプリズムの小型化を助長する。

【0045】b. 多画素化する液晶パネルの入力端子数の増加にも対応でき、しかも、可撓性を有するフレキシブル基板であるため端子接続部への外力の加わる際、ダンパーとなる。

【0046】(5) 分離光学手段は赤・青・緑光の三原色光を二色以下に混合して分離し、合成光学手段に固定する液晶パネルは二つ以下としたことによって、

a. 低開口率の液晶パネル使用によるスクリーン照度低下をカバーしながら、製品サイズは小型にできる利点を有する。

【0047】(6) 液晶パネルを構成する後偏光板を合成光学手段の出射光面のみに配置したことによって、

a. 後偏光板の使用個数及び貼り付け工数低減が図れると共に、より簡素な構造にすることができる。

【0048】b. 偏光板を用いた高輝度スクリーンとの特性面・性能面のマッチングが柔軟に対応することができ、商品性を高められる。

【0049】c. 将来、P D L C (高分子分散型液晶)を用いた液晶パネルを使用した場合、偏光板不要の利点を生かしてより簡素な構造にでき、しかも、ランプ光の偏光不要という利点を生かして光学系の一層の小型化と明るさ増加といった相矛盾した条件を満足させることに大きく寄与できる。

【0050】そこで本発明は、上述したような効果を得たことにより、小型・軽量・安価・品質・信頼性・取扱い性・可搬性・設置性およびデザイン性等を向上させた液晶プロジェクターの商品を提供することを可能とする。

【図面の簡単な説明】

【図1】 本発明の一実施例を示す液晶プロジェクターの光学系の構造を示す概略平面図。

【図2】 図1を応用展開した本発明の一実施例を示す光学系の構造を示す概略平面図。

【図3】 図1を応用展開した本発明の一実施例を示す光学系の構造を示す概略平面図。

【図4】 図1の合成光学手段の部分のみを拡大した部分拡大図。

【図5】 図4に対応した部分組立断面図。

【図6】 図4の合成光学手段を応用展開した部分拡大図。

【図7】 図4の合成光学手段を応用展開した部分拡大図。

【図8】 図7の合成光学手段を応用展開した部分拡大図。

【符号の説明】

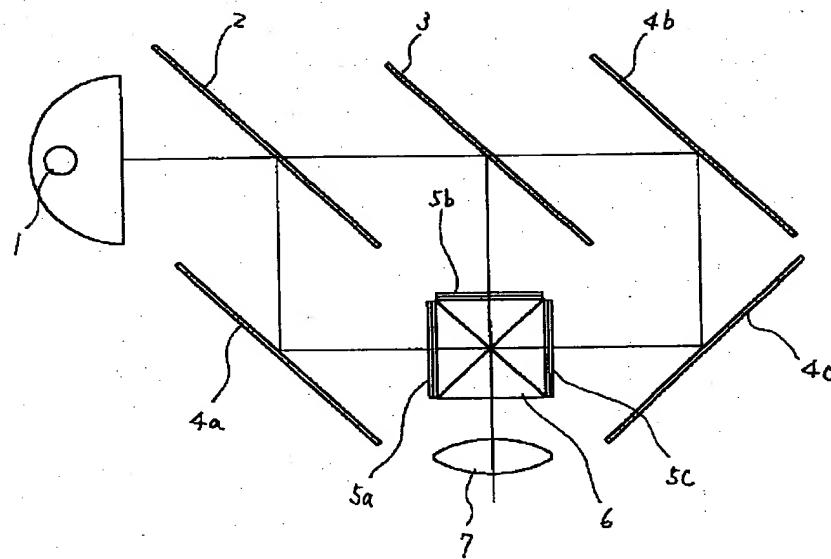
(6)

9
 2 ダイクロイックミラー
 3 ダイクロイックミラー
 4 a 反射ミラー
 4 b 反射ミラー
 4 c 反射ミラー
 5 a 液晶パネル
 5 b 液晶パネル
 5 c 液晶パネル
 6 ダイクロイックプリズム
 7 投射レンズ
 8 a 後偏光板
 8 b 後偏光板

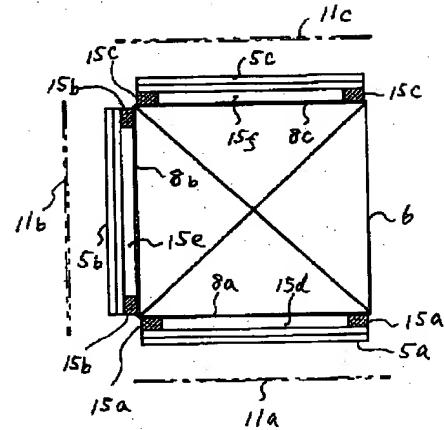
10

8 c 後偏光板
 9 CCD
 10 専用ランプ
 11 a 前偏光板
 11 b 前偏光板
 11 c 前偏光板
 13 フレキシブルプリント基板
 14 異方性導電膜
 15 a 中間部材
 15 b 中間部材
 15 c 中間部材

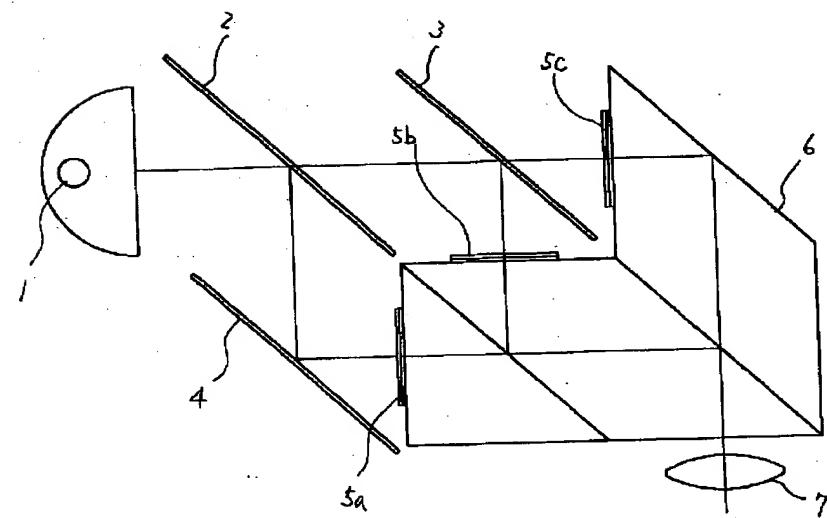
【図1】



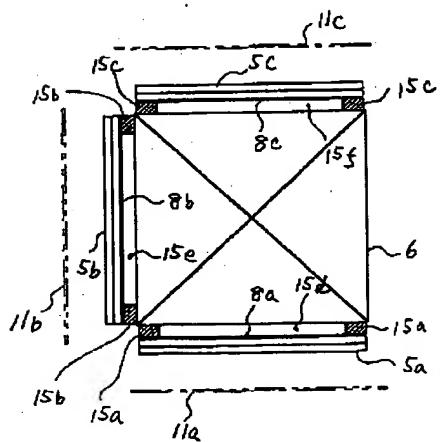
【図6】



【図2】

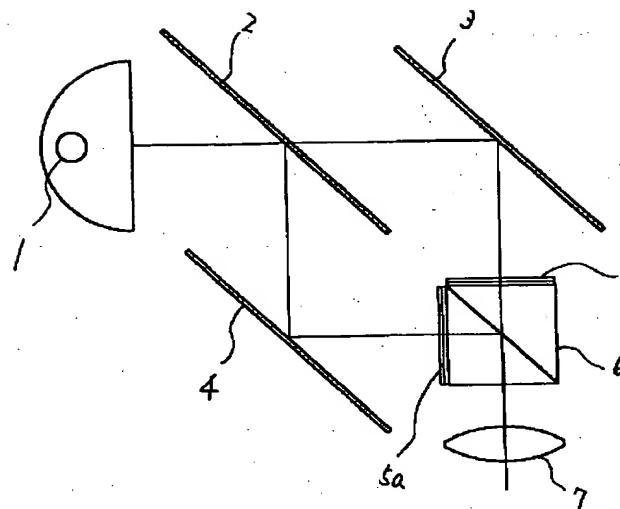


【図7】

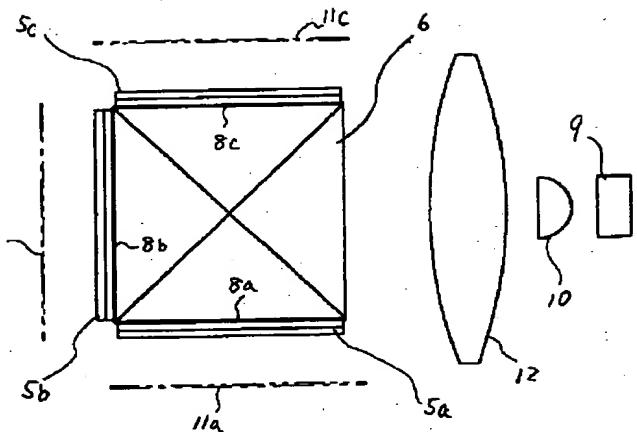


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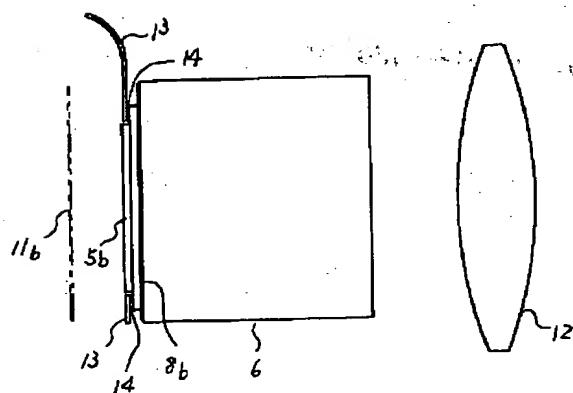
【図3】



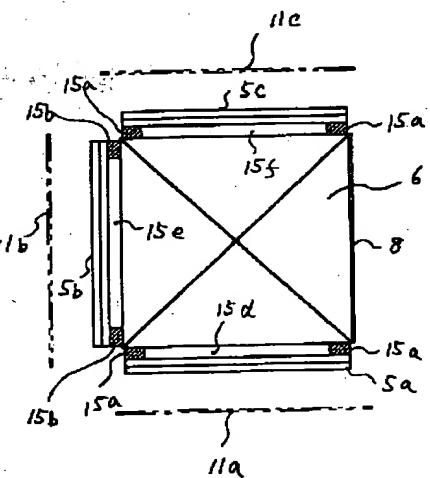
【図4】



【図5】



【図8】



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CLAIMS

[Claim(s)]

[Claim 1] At least By the synthetic optical means and this synthetic optical means which compounds the red, the blue, and **** modulated by the circuit means and the aforementioned liquid crystal panel which drives and controls the liquid crystal panel and this liquid crystal panel which modulates each of the separation optical means, the aforementioned red, the blue, and **** which divides the light source and this light source into red, blue, and **** Structure of the liquid crystal projector characterized by constituting in the liquid crystal projector which has the projector lens which projects the compounded image light so that said liquid crystal panel may be fixed to said synthetic optical means.

[Claim 2] It is the structure of the liquid crystal projector characterized by constituting said synthetic optical means combining at least one or more dichroic prisms or cross mirrors etc. in the structure of the liquid crystal projector which consists of whereas clauses of said claim 1.

[Claim 3] It is the structure of the liquid crystal projector characterized by said synthetic optical means being constituted by the one configuration of a quadrilateral or L typeface in the structure of the liquid crystal projector which consists of whereas clauses of said claim 1.

[Claim 4] Structure of the liquid crystal projector characterized by considering as the structure which stuck said liquid crystal panel on said synthetic optical means directly in the structure of the liquid crystal projector which consists of whereas clauses of said claim 1.

[Claim 5] Structure of the liquid crystal projector characterized by considering as the structure of sticking said liquid crystal panel on said synthetic optical means through pars intermedia material, in the structure of the liquid crystal projector which consists of whereas clauses of said claim 1.

[Claim 6] It is the structure of the liquid crystal projector characterized by considering as the structure of having the flexible printed circuit board which fixed so that it could be flowed through said liquid crystal panel in the structure of the liquid crystal projector which consists of whereas clauses of said claim 1, and aiming at said circuit means and flow

[Claim 7] Said liquid crystal panel which said separation optical means mixes the three-primary-colors light of red, blue and **** below to a two color, separates it in the structure of the liquid crystal projector which consists of whereas clauses of said claim 1, and is fixed to said synthetic optical means is the structure of the liquid crystal projector characterized by being referred to or less as two.

[Claim 8] Structure of the liquid crystal projector characterized by having arranged the polarizing plate only to outgoing radiation **** of said synthetic optical means in the structure of the liquid crystal projector which consists of whereas clauses of said claim 1 after constituting said liquid crystal panel.

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DETAILED DESCRIPTION

Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the structure of the optical system of a liquid crystal projector where the liquid crystal panel was used.

[0002]

[Description of the Prior Art] Conventionally, each of the liquid crystal panels 54, 55, and 56 mounted in the circuit board is ****ed, and the stop of it is carried out to support plates 65 and 66, and it is united with them as indicated by invention "a liquid crystal projector" of (1) Japanese Patent Application No. No. 133872 [63 to]. With the spring 64, adjustment of location decision order, right and left, and up down (3 shaft orientations) is needed for the superior lamella 59 of the optical head 17 for this. Moreover, each of liquid crystal panel 7a and 7c mounted in the circuit board 10 is fixed to a stationary plate A as indicated by invention "a projection form liquid crystal projector" of (2) Japanese Patent Application No. No. 28430 [three to]. By mutual combination association of four kinds of stationary plates of stationary-plate A-D, the alignment positioning adjustment between the pixels of right and left, the upper and lower sides, and a hand of cut (3 shaft orientations) is needed. Furthermore, the adjustment device which enables focal doubling positioning adjustment of order and the direction (3 shaft orientations) of pitching (pitching) yawing (piece ****), i.e., adjustment of a total of six shaft orientations, through a stationary plate D and two sorts of up-and-down accessory plates 29-34 by combination association with up-and-down case 8a and 8b is needed.

[0003]

[Problem(s) to be Solved by the Invention] However, it is going to double the mutual pixel location of the liquid crystal panel red, blue, and for **** with a precision, and further, an adjustment function will be complicated, so that it is going to double the focus of the projection screen to a screen vividly. In addition, it is also the same as when forming a high pixel more, and the following troubles are produced.

[0004] (a) In an adjustment device, probably, since it consists of glass material, reinforcement, in order to protect and flow join together, every time a liquid crystal panel does not use inclusion members, such as the circuit board, it is not incorporable into an adjustment device. For this reason, the need lower limit of an adjustment device is decided, and to the size of an original small liquid crystal panel, an adjustment device becomes large and serves as ** and complicated structure. Next, while only the amount which considers a part for the configuration of the complicated mechanism element and a location tolerance becomes still larger in addition to a part for the adjustment stroke which performs adjustment of three shafts or 6 shaft orientations, the flat-surface size for the body of optical system will be decided by taking the tooth space which aims at interference prevention between adjustment devices. Therefore, an optical unit and a product will weight[large-sized and]-ize.

[0005] That is, even if it miniaturizes a liquid crystal panel and a dichroic prism, it has the structural limitation that an optical unit cannot make small only the miniaturized amount.

[0006] Next, since the back focus of a projector lens becomes large and activity lens number of sheets increases by considering as the structure which accumulated mutually the member to which each shaft orientations are made to adjust in order to perform adjustment of three shafts or 6 shaft orientations, it large-sized-izes.

[0007] Therefore, the constraint to the product design and design by enlargement and weight-izing of a product is made [many], and it has become a brake to a handling nature, portability, and installation disposition top.

[0008] (b) Complication of adjustment structure makes components mark increase. The direct reason of the increment in components mark and the enlargement (especially optics) of components is carried out at the increment in cost.

[0009] (c) Assembly-operation manday also increases in proportion to components mark. Current [in which the commercial scene is not formed], and automation cannot be attained, so that a liquid crystal projector carries out high

production. Therefore, the increment in assembly expense is not avoided in the situation depending on an artificial number.

[0010] (d) Require especially tuning many [artificial]. It will account for several percent or more in a conversion cost.

[0011] Moreover, since it is easy to produce the parts replacement within a process (mainly optic), it is easy to generate the increase of manday. Furthermore, when performing after-sale service, education serves as a big neck on employment difficultly.

[0012] (e) It is serious to stabilize pixel doubling and a focal doubling precision moreover in homogeneity. The work environment by people is dark in order to enable it to be adjusted by seeing the image projected on a screen. Under these conditions, it is because it is very easy to get tired that it is hard to continue nervous concentration.

[0013] (f) In an engine-performance side, first, when gap (it is henceforth called pixel gap) of the mutual pixel location of a liquid crystal panel receives an impact and an oscillation, it is easy to be generated. It originates in what depends on distortion and location gap of the adjustment device itself, and the thing which depends on distortion of a case getting across to an adjustment device. using the manufacture approach (for example, welding reinforcement of aluminum dies casting manufacture, the increment in board thickness of a pressing, and a rib) which suited it in the bottom case of an optical unit with the construction material which has rigidity in order to prevent this **** -- the distorted propagation to a sheathing case and an optical unit -- being hard -- structure is not adopted or the cost rise and enlargement by components reinforcement etc. are not avoided.

[0014] Next, the light reflected in the member from which a part of flux of light from the lamp of the light source constitutes an adjustment device turns into the stray light about image quality. Moreover, the light reflected between the liquid crystal panel and the polarizing plate also turns into the stray light. Dotage is made easy for the stray lights, such as this, to be understood by the projector lens, and to drop the contrast of a projection image or to produce. Furthermore the gap of the liquid crystal layer of a liquid crystal panel is also affected not a little by distortion which joins an adjustment device. By this, about change of transmission, the synthetic balance of a lifting, red, blue, and **** is lost, and it becomes the reason of color nonuniformity. In order to prevent this etc., an adjustment device and an optical unit will be enlarged inevitably, and it will become heavy.

[0015] Next, it becomes an elevated temperature when a liquid crystal panel shades. Although it is necessary to cool this, a liquid crystal panel is narrow, since it is equipped in the complicated device, in order to cool proper, needs the rectification structure of the air for cooling, and needs the wind pressure and wind speed which overcome ** and a flow resistance. Therefore, the noise becomes large, in order for the structure for cooling to become complicated and to use the big cooling fan of power. Moreover, although the amount of [of the liquid crystal panel which the flux of light of a lamp light concentrates] center section becomes an elevated temperature, in the present cooling system, it cannot cool enough, therefore has become a regulation factor by the side of the elevated temperature of the operating temperature limits of a product.

[0016]

[Means for Solving the Problem] Structure of the liquid crystal projector of this invention (1) At least By the synthetic optical means and this synthetic optical means which compounds the red, the blue, and **** modulated by the circuit means and the aforementioned liquid crystal panel which drives and controls the liquid crystal panel and this liquid crystal panel which modulates each of the separation optical means, the aforementioned red, the blue, and **** which divides the light source and this light source into red, blue, and **** In the liquid crystal projector which has the projector lens which projects the compounded image light, it is characterized by constituting so that said liquid crystal panel may be fixed to said synthetic optical means.

[0017] (2) In the structure of the liquid crystal projector which consists of whereas clauses of said claim 1, it is characterized by constituting said synthetic optical means combining at least one or more dichroic prisms or cross mirrors etc.

[0018] (3) In the structure of the liquid crystal projector which consists of whereas clauses of said claim 1, it is characterized by said synthetic optical means being constituted by the one configuration of a quadrilateral or L typeface

[0019] (4) In the structure of the liquid crystal projector which consists of whereas clauses of said claim 1, it is characterized by considering as the structure which stuck said liquid crystal panel on said synthetic optical means directly.

[0020] (5) In the structure of the liquid crystal projector which consists of whereas clauses of said claim 1, it is characterized by considering as the structure of sticking said liquid crystal panel on said synthetic optical means through pars intermedia material.

[0021] (6) In the structure of the liquid crystal projector which consists of whereas clauses of said claim 1, it is

characterized by making said liquid crystal panel into the structure of having the flexible printed circuit board which fixed so that it could flow, and aiming at said circuit means and flow.

[0022] (7) In the structure of the liquid crystal projector which consists of whereas clauses of said claim 1, said separation optical means mixes the three-primary-colors light of red, blue, and **** below in two-color light, and is separated, and it is characterized by setting or less to two said liquid crystal panel fixed to said synthetic optical means.

[0023] (8) In the structure of the liquid crystal projector which consists of whereas clauses of said claim 1, after constituting said liquid crystal panel, it is characterized by having arranged the polarizing plate only to outgoing radiation **** of said synthetic optical means.

[0024]

[Example] Hereafter, the example of the structure of the liquid crystal projector of this invention is explained to a detail using a drawing.

[0025] The outline top view of the optical unit which drawing 1 shows one example of this invention, drawing 2, and drawing 3 are the outline top views showing one example which carried out application expansion, drawing 4, drawing 6, and drawing 7 are the elements on larger scale which expanded only the part of the synthetic optical means of drawing 1, and drawing 5 is a partial assembly sectional view corresponding to drawing 4. The metal halide lamp whose 1 is the light source, the dichroic mirror with which 2-3 divides a lamp light into red, blue, and ****, 4a, 4b, and 4c constitute a separation optical means from a reflective mirror which transmits each separated light. The liquid crystal panel with which 5a, 5b, and 5c modulate red, blue, and ****, the dichroic prism which 6 compounds the light modulated as a synthetic optical means, and is made into image light, and 7 are projector lenses which carry out amplification projection of the image light. The detail of the synthetic optical means 6 pastes up after polarizing plate 8a, 8b, and 8c on said dichroic prism 6, and fixes said liquid crystal panel 5a, 5b, and 5c with a binder with UV adhesives or light guide nature on this 8a, 8b, and 8c as it is first shown in drawing 4 and drawing 5. In addition, mutual pixel doubling of said liquid crystal panel 5a, 5b, and 5c projects on CRT (abbreviation among drawing) etc. the image which shot using CCD9 using the lamination fixture, and carries out pixel doubling tuning. Of course, it can also carry out perfect regulating automatically with an automatic machine. The method which it illuminates [method] with the exclusive lamp 10 from said CCD side, or makes said liquid crystal panel 5a, 5b, and 5c penetrate is also possible for the illumination light which shoots by said CCD9. the alignment mark (patterns for recognition, such as the shape of the duplex rectangular head established in the pixel group periphery section, or a square) used at the time of the activity which sticks the glass plate of two sheets which constitutes liquid crystal panel 5a, 5b, and 5c in this pixel doubling activity -- using -- simplicity and ** -- it is effective if it doubles precisely. Moreover, adjustment of photography distance is also possible so that a lens 12 may be arranged and CCD9 can be shot at once between said prism 6 and said CCD9. In addition, the synthetic optical means 6 may be the thing of an impounding basin ROIKKU cross mirror method.

[0026] Next, it dissociates with said liquid crystal panel 5a, 5b, and 5c, and the polarizing plate before 11a, 11b, and 11 is arranged. (of course, if cooling effectiveness is high, unification is also possible) The flexible substrate 13 which uses polyimide or polyester as the base material through anisotropy ***** of 14 was flowed through and stuck by pressure at the terminal area formed in said liquid crystal panel 5b, and the other end is connected to a circuit means (abbreviation among drawing) with the connector etc. as shown in drawing 5. Said flexible substrate 13 is minute, and since it can form ** and a double-sided pattern, it does not become the failure of a miniaturization of said prism 6.

[0027] Next, a point of difference with drawing 4 is explained about drawing 6. 15a, 15b, and 15c (two pieces each) are pars intermedia material which consists of the metal or resin material which raised dimensional accuracy in the direction of an optical axis, and is carrying out arrangement immobilization between said after polarizing plate 8a, 8b and 8c, and said liquid crystal panel 5a, 5b and 5c. Space section 15d and 15 e.15f formed of said spacer 15a, 15b, and 15c are raising the attachment-and-detachment nature of said liquid crystal panel 5a, 5b, and 5c while accomplishing the passage of the air for cooling. In addition, said pars intermedia material 15a, 15b, and 15c are pasted up with UV adhesion or a binder. It is also possible to form pars intermedia material only with UV adhesives depending on said crevice between space section 15d and 15 e.15f.

[0028] Next, drawing 7 also explains a point of difference with drawing 4. Said spacer 15a, 15b, and 15c are arranged between said prism 6, and after polarizing plate 8a, 8b and 8c.

[0029] Now, a point of difference with drawing 1 is explained about drawing 2. The synthetic optical means 6 is coalesce of the dichroic prism which carried out the configuration of L typeface, and as shown in drawing, it is fixing liquid crystal panel 5a, 5b, and 5c. The fixed approach and structure are the same as the above. Moreover, drawing 3 divides a lamp light into green and Magenta light with the dichroic mirror 2-3 which constitutes a separation optical means, 1 colored light in it is reflected by the reflecting plate 4, it is reflected by said dichroic mirror 3 and other 1

colored light results in liquid crystal panel 5a at liquid crystal panel 5b. The light modulated by said liquid crystal panel 5a and 5b is compounded by the dichroic prism 6 as a synthetic optical means, and turns into image light, and amplification projection is carried out with the projector lens of 7.

[0030] Next, when drawing 8 sticks the after polarizing plate 8 only on outgoing radiation **** of said dichroic prism 6, said liquid crystal panel 5a, 5b, and 5c show the structure which arranges only before polarizing plate 11a, 11b, and 11c. It sticks with the number of components of the after polarizing plate 8, and ** to a manday cutback.

[0031]

[Effect of the Invention] This invention is (1) as explained in full detail above. By constituting so that a liquid crystal panel may be fixed to a synthetic optical means, and constituting said synthetic optical means combining at least one or more dichroic prisms or cross mirrors etc., said synthetic optical means can make a. adjustment device unnecessary, when constituted by the one configuration of a quadrilateral or L typeface. By this, the structural constraint to the miniaturization of an optical unit (product) can be abolished, and the liquid crystal panel and own miniaturization of a dichroic prism can be ***** (ed) now. Thereby, the liquid crystal panel which used poly-Si TFT with a built-in driver line can realize small and metrization of the product which carried out the small merit in *****.

[0032] b. Raise the degree of freedom of a product design and a design, and the above-mentioned a term enables it to aim at improvement and an improvement of handling nature, portability, and installation nature more.

[0033] c. The structure of an optical unit can be simplified much more by a components cutback and miniaturization. Thereby, large cost reduction can be planned by adoption of the assembly arrangement of a throwing-in method, and the cutback of tuning. Furthermore, after-sale service nature also improves.

[0034] d. the size of a dichroic prism -- the size of a liquid crystal panel -- an EQC or **** -- since it becomes good with large extent, the back focus of a projector lens can be made brief. Therefore, it becomes usable [a small projector lens with little activity lens number of sheets]. As this effectiveness, the amount of swallowing of the flux of light can increase, and a screen illuminance can be increased, and it can contribute to small and metrization, and cost reduction greatly.

[0035] e. It equalizes, and pixel doubling and a focal adjustment precision can be **(ed), and can be raised. The precision of the direction of a focus of the amount of gaps of the focal location within allowance ***** is possible for a projector lens location and the **** absorption with the dimensional accuracy of a dichroic prism, and it is because pixel doubling enables the fixture or machine doubling activity which used CCD from the visual activity.

[0036] f. Don't produce pixel gap according to the disturbance by an oscillation, an impact, etc., either. It is because a liquid crystal panel is fixed to the dichroic prism which has rigidity, so deformation, location gap, etc. can be prevented. The design load which the constraint to the construction material, the manufacture approach, etc. of the case of an optical unit is lost, and the case by resin material also becomes possible by this, and pays the consideration about distortion, such as reinforcement, structure, etc. to a sheathing case, beyond the need is also mitigable.

[0037] g. Since the stray light which a lamp light reflects irregularly on an adjustment device, and starts can be stopped, it can prevent spoiling the contrast of a projection image.

[0038] (2) Since the prism which has a. rigidity by having considered as the structure which stuck the liquid crystal panel on the synthetic optical means directly serves a liquid crystal panel as reinforcement, lose change of the gap of a liquid crystal layer and color nonuniformity prevention is enabled.

[0039] b. Since the heat capacity of prism is still larger, generation of heat of a liquid crystal panel is taken, and it has the cooling effect.

[0040] (3) By having considered as the structure of sticking a liquid crystal panel on a synthetic optical means through pars intermedia material, the space section produced by pars intermedia material can form the passage of the air for cooling between a. prism and a liquid crystal panel, and a liquid crystal panel can be cooled from a table rear face. Since flow resistances including adjustment device deletion can be lowered with this, the cooling fan of low power can be used and low noise-ization can be attained.

[0041] b. Since it lets whole this invention pass and the adjustment machine of a liquid crystal panel circumference par is deleted in addition, the tooth space in which the spot cooling structure where the air drawn from the passage from a cooling fan so that a part for the center section of the liquid crystal panel which the flux of light concentrates might be cooled to a subject is sprayed by the nozzle is prepared is secured. The allowance operating temperature limits of a product can be extended by holding down the peak value of liquid crystal panel generation of heat by this spot cooling.

[0042] c. Since a lamp light bundle can be increased when the cooling effectiveness of a liquid crystal panel increases, can respond, without dropping a lamp light bundle also on a small liquid crystal panel with a small numerical aperture, or the liquid crystal panel which is many pixels.

[0043] d. It becomes refreshable [only by carrying out desorption to an excellent article only by removing the

components concerned of said pars intermedia material 15a, 15b, and 15c, even when it becomes a defect in a commercial scene] in process [any of liquid crystal panel 5a, 5b, and 5c they are], and can carry out by the cutback of cast-away components, and easy exchange. Especially, after-sale service nature can be improved and a consumer's amount of a costs burden can be reduced.

[0044] (4) By having the flexible printed circuit board which fixed so that it could be flowed through a liquid crystal panel, and having considered as the structure of aiming at a circuit means and a flow, since minute and a double-sided pattern are possible and the degree of freedom of a design is high, a. flexible printed circuit board promotes the miniaturization of a liquid crystal panel and prism, when a small substrate design can be performed.

[0045] b. It can respond also to the increment in the number of input terminals of a liquid crystal panel formed into many pixels, and it becomes a damper in case the external force to the terminal strapping section is moreover added, since it is the flexible substrate which has flexibility.

[0046] (5) A separation optical means mixes the three-primary-colors light of red, blue, and **** below to a two color, and is separated, and while the liquid crystal panel fixed to a synthetic optical means covers the screen illuminance lowering by the liquid crystal panel activity of an a. low numerical aperture by having been referred to or less as two, product size has the advantage made small.

[0047] (6) It can be made simpler structure, while being able to aim at the activity number of an after [a.] polarizing plate, and attachment manday reduction by having arranged the polarizing plate only to outgoing radiation **** of a synthetic optical means after constituting a liquid crystal panel.

[0048] b. Matching of a property side and an engine-performance side with the high brightness screen using a polarizing plate can respond flexibly, and has salability raised.

[0049] c. the case where the liquid crystal panel using PDLC (polymer dispersed liquid crystal) is used in the future -- a polarizing plate, taking advantage of an unnecessary advantage, it is made to simpler structure, and, moreover, can contribute to satisfying the conditions of much more miniaturization and the increment in brightness in optical system which carried out phase conflict taking advantage of the advantage of the polarization needlessness of a lamp light greatly.

[0050] then, the thing for which this invention acquired effectiveness which was mentioned above -- small and light weight - cheap -- it makes it possible to offer the goods of the liquid crystal projector which raised - quality, dependability, handling nature, portability, installation nature, design nature, etc.

[Translation done.]

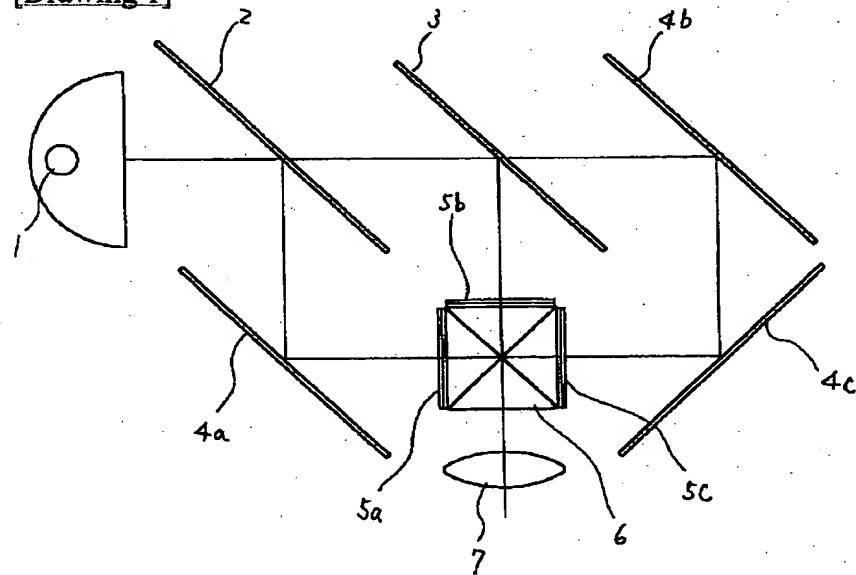
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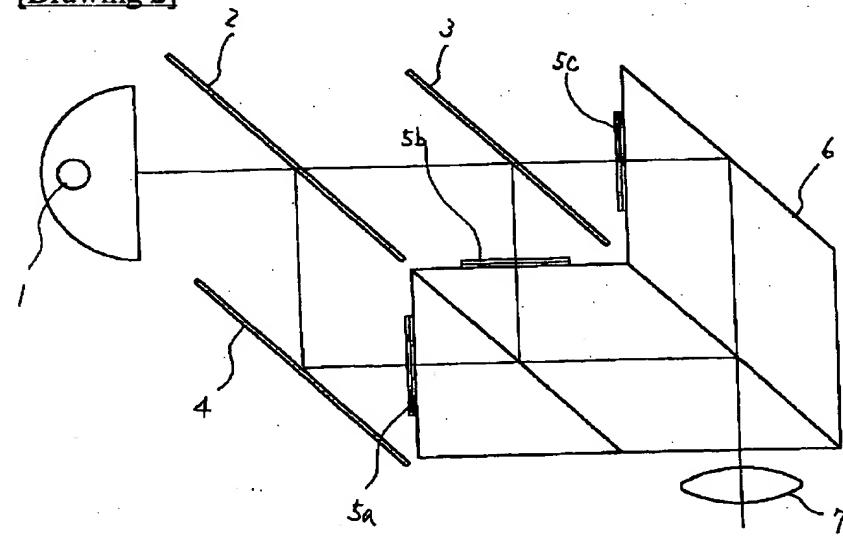
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DRAWINGS

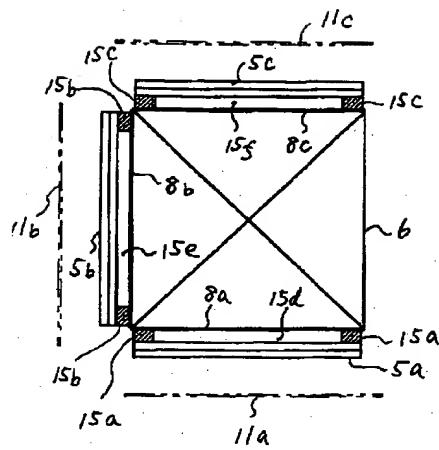
[Drawing 1]



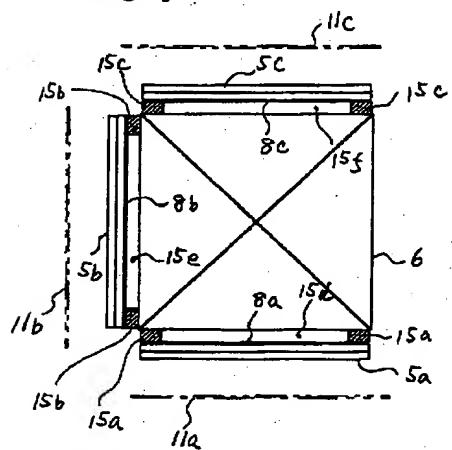
[Drawing 2]



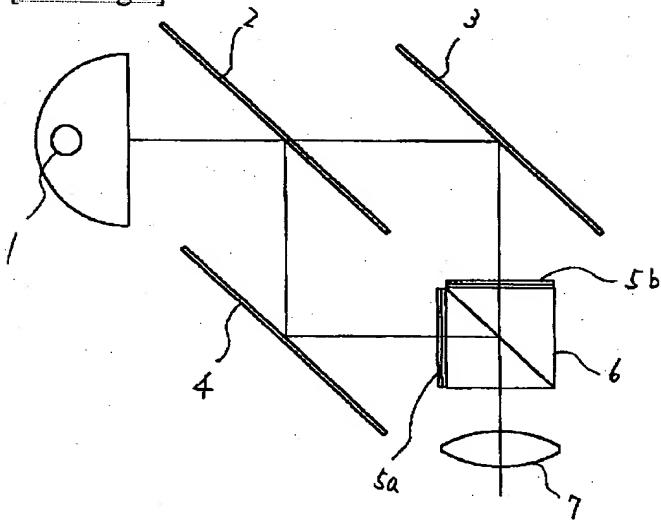
[Drawing 6]



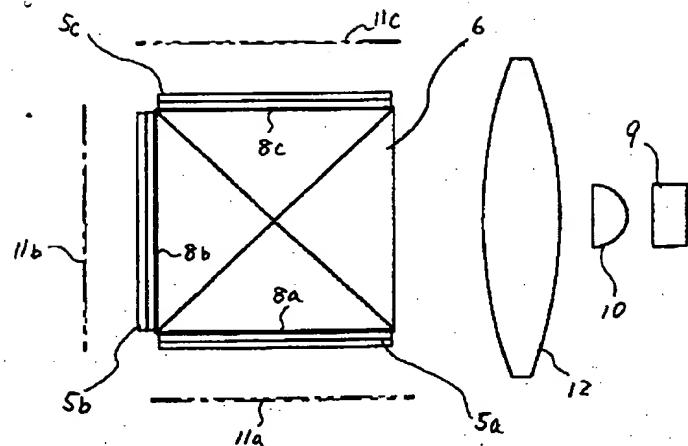
[Drawing 7]



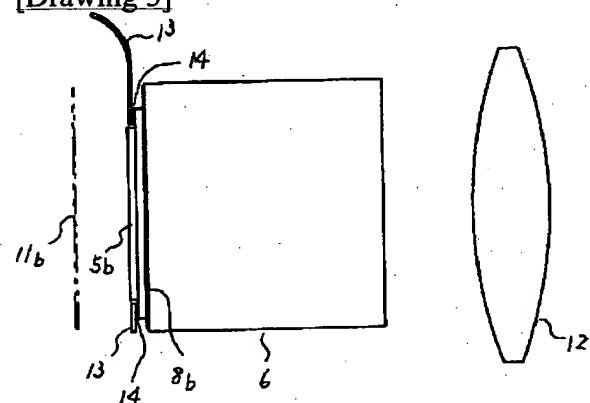
[Drawing 3]



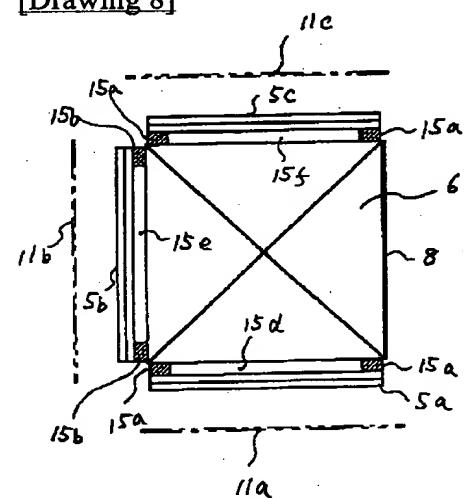
[Drawing 4]



[Drawing 5]



[Drawing 8]



[Translation done.]

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CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law

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[Procedure amendment]

[Filing Date] August 30, Heisei 11 (1999. 8.30)

[Procedure amendment 1]

[Document to be Amended] Description

[Item(s) to be Amended] The name of invention

[Method of Amendment] Modification

[Proposed Amendment]

[Title of the Invention] Liquid crystal projector

[Procedure amendment 2]

[Document to be Amended] Description

[Item(s) to be Amended] Claim

[Method of Amendment] Modification

[Proposed Amendment]

[Claim(s)]

[Claim 1] The light source and the separation optical means which divides the light from said light source into the light of two or more colors,

Two or more liquid crystal panels which modulate each of the light of said two or more colors,

The synthetic optical means which compounds the light modulated with said liquid crystal panel,

In the liquid crystal projector which has the projector lens which projects the light compounded by said synthetic optic means,

It comes to stick said liquid crystal panel on the field of said color composition means through pars intermedia materia

The liquid crystal projector characterized by said pars intermedia material coming to form the space section between said liquid crystal panel and said color composition means.

[Claim 2] Light source,

The separation optical means which divides the light from said light source into the light of two or more colors,
 Two or more liquid crystal panels which modulate each of the light of said two or more colors,
 The synthetic optical means which compounds the light modulated with said liquid crystal panel,
 In the liquid crystal projector which has the projector lens which projects the light compounded by said synthetic optical means,

A polarizing plate pastes the field of said color composition means,

It comes to stick said liquid crystal panel on said polarizing plate through pars intermedia material,

The liquid crystal projector characterized by said pars intermedia material coming to form the space section between said liquid crystal panel and said color composition means.

[Claim 3] In a liquid crystal projector according to claim 1 or 2,

Said pars intermedia material is a liquid crystal projector characterized by being adhesives.

[Claim 4] In a liquid crystal projector according to claim 1 to 3,

The liquid crystal projector characterized by said space section accomplishing the passage of the air for cooling.

[Procedure amendment 3]

[Document to be Amended] Description

[Item(s) to be Amended] 0016

[Method of Amendment] Modification

[Proposed Amendment]

[0016]

[Means for Solving the Problem] Structure of the liquid crystal projector of this invention,

(1) The light source and the separation optical means which divides the light from said light source into the light of two or more colors, Two or more liquid crystal panels which modulate each of the light of said two or more colors, and the synthetic optical means which compounds the light modulated with said liquid crystal panel, In the liquid crystal projector which has the projector lens which projects the light compounded by said synthetic optical means It is characterized by coming to stick said liquid crystal panel on the field of said color composition means through pars intermedia material, and said pars intermedia material coming to form the space section between said liquid crystal panel and said color composition means.

[Procedure amendment 4]

[Document to be Amended] Description

[Item(s) to be Amended] 0017

[Method of Amendment] Modification

[Proposed Amendment]

[0017] (2) The light source and the separation optical means which divides the light from said light source into the light of two or more colors, Two or more liquid crystal panels which modulate each of the light of said two or more colors, and the synthetic optical means which compounds the light modulated with said liquid crystal panel, In the liquid crystal projector which has the projector lens which projects the light compounded by said synthetic optical means It is characterized by a polarizing plate pasting the field of said color composition means, coming to stick said liquid crystal panel on said polarizing plate through pars intermedia material, and said pars intermedia material coming to form the space section between said liquid crystal panel and said color composition means.

[Procedure amendment 5]

[Document to be Amended] Description

[Item(s) to be Amended] 0018

[Method of Amendment] Modification

[Proposed Amendment]

[0018] In a liquid crystal projector given in (3), (1), or (2), said pars intermedia material is characterized by being adhesives.

[Procedure amendment 6]

[Document to be Amended] Description

[Item(s) to be Amended] 0019

[Method of Amendment] Modification

[Proposed Amendment]

[0019] In a liquid crystal projector given in either (4), (1) or (3), it is characterized by said space section accomplishing the passage of the air for cooling.

[Procedure amendment 7]
[Document to be Amended] Description
[Item(s) to be Amended] 0020
[Method of Amendment] Deletion
[Procedure amendment 8]
[Document to be Amended] Description
[Item(s) to be Amended] 0021
[Method of Amendment] Deletion
[Procedure amendment 9]
[Document to be Amended] Description
[Item(s) to be Amended] 0022
[Method of Amendment] Deletion
[Procedure amendment 10]
[Document to be Amended] Description
[Item(s) to be Amended] 0023
[Method of Amendment] Deletion
[Procedure amendment 11]
[Document to be Amended] Description
[Item(s) to be Amended] 0031
[Method of Amendment] Modification
[Proposed Amendment]

[0031] It explained [above] in full detail and needs,

(1) By constituting so that a liquid crystal panel may be fixed to a synthetic optical means, and constituting said synthetic optical means combining at least one or more dichroic prisms or cross mirrors etc., said synthetic optical means can make a. adjustment device unnecessary, when constituted by the one configuration of a quadrilateral or L typeface. By this, the structural constraint to the miniaturization of an optical unit (product) can be abolished, and the liquid crystal panel and own miniaturization of a dichroic prism can be ***** (ed) now. Thereby, the liquid crystal panel which used poly-Si TFT with a built-in driver line can realize small and lightweight-ization of the product which carried out the small merit in *****.

[Procedure amendment 12]
[Document to be Amended] Description
[Item(s) to be Amended] 0034
[Method of Amendment] Modification
[Proposed Amendment]
[0034] d. the size of a dichroic prism -- the size of a liquid crystal panel -- an EQC or **** -- since it becomes good with large extent, the back focus of a projector lens can be made brief. Therefore, it becomes usable [a small projector lens with little activity lens number of sheets]. As this effectiveness, the amount of swallowing of the flux of light can increase, and a screen illuminance can be increased, and it can contribute to small and lightweight-izing, and cost reduction greatly.

[Procedure amendment 13]
[Document to be Amended] Description
[Item(s) to be Amended] 0050
[Method of Amendment] Modification
[Proposed Amendment]
[0050]

[Effect of the Invention] this invention acquired effectiveness which was mentioned above -- small and light weight - cheap -- it makes it possible to offer the liquid crystal projector which raised - quality, dependability, handling nature, portability, installation nature, design nature, etc.

[Translation done.]